Missouri River Basin Water Management
2010 Flood Operations

September 21, 2010
9:00 a.m. Columbia, Missouri
7:00 p.m. Oregon, Missouri

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US Army Corps of Engineers
BUILDING STRONG®

Missouri River Mainstem Reservoir System

Congressionally Authorized

Project Purposes

- Flood Control
- Navigation
- Hydropower
- Irrigation
- Recreation
- Water Supply
- Water Quality
- Fish and Wildlife

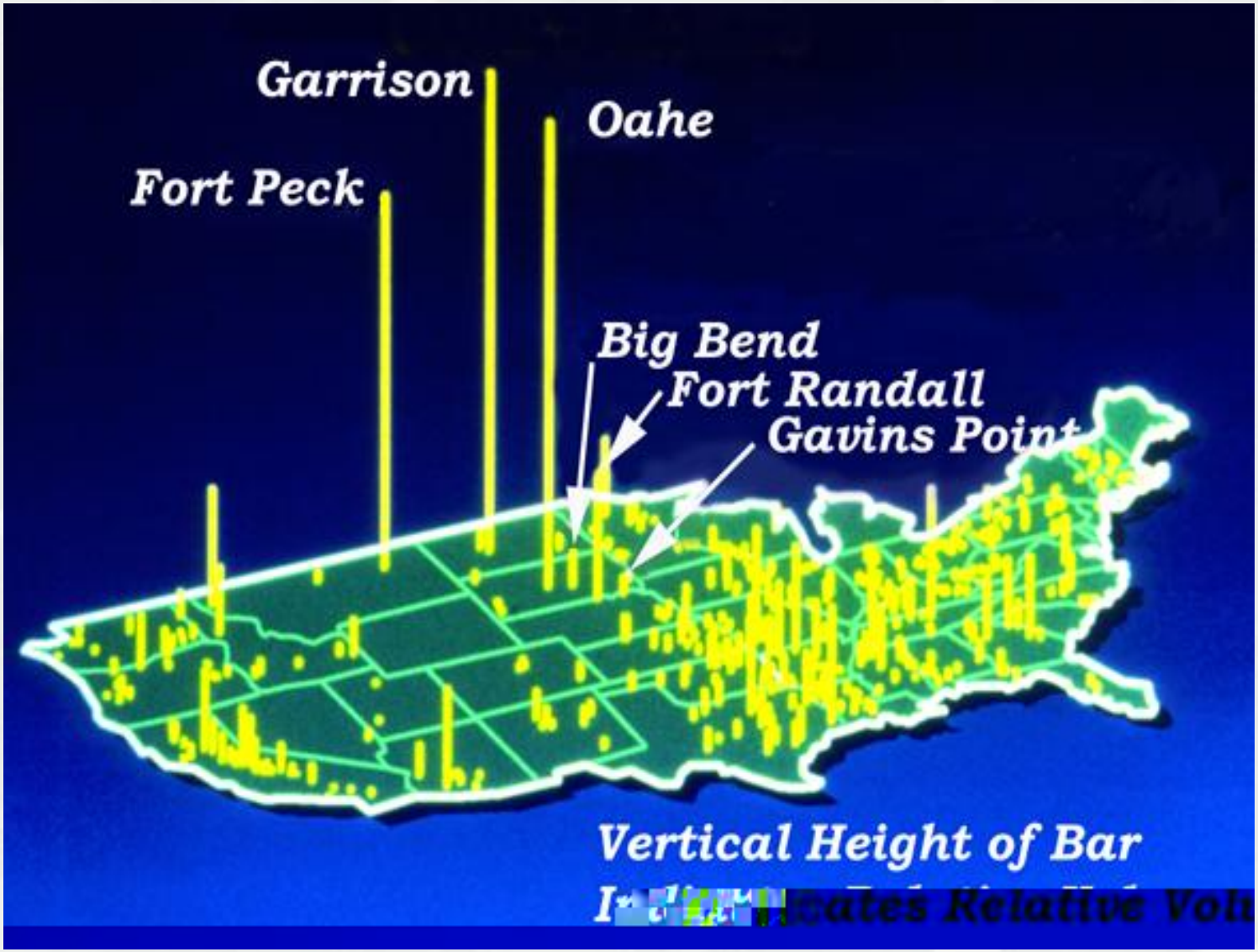
(Including endangered species)

Bank Stabilization and Navigation Project

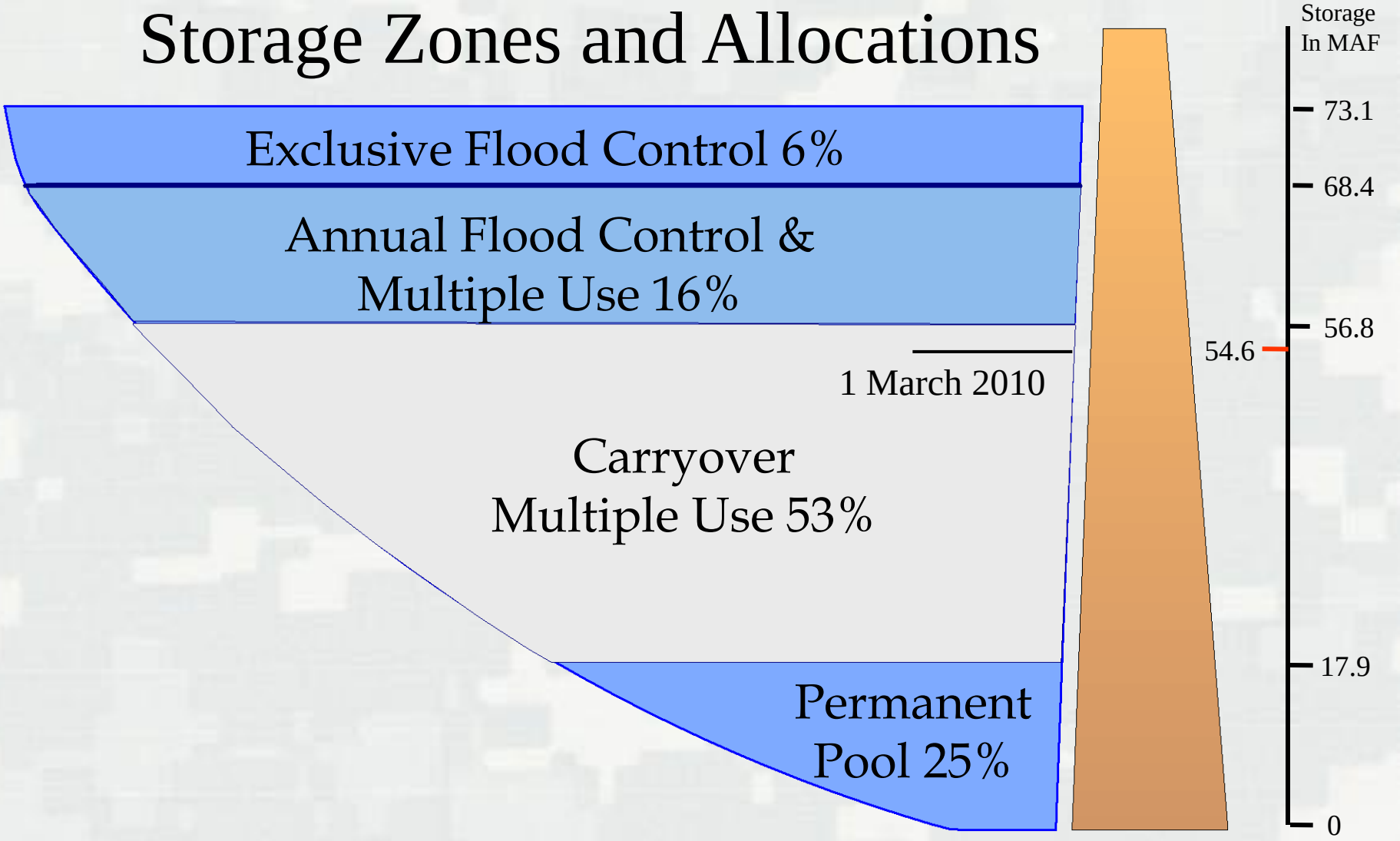
Sioux City, IA – St. Louis, MO

BUILDING STRONG®

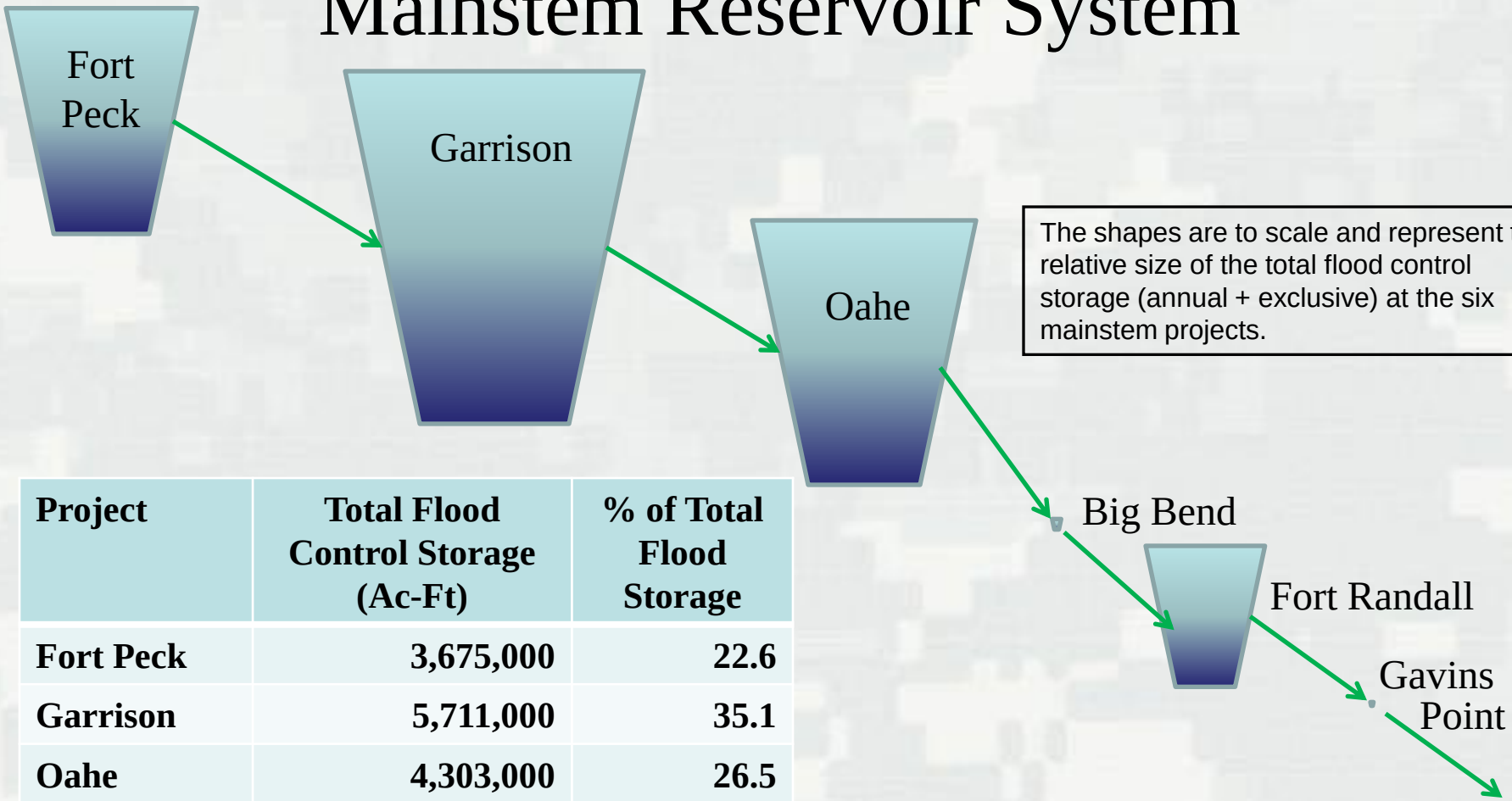
Storage Capacity of Corps Reservoirs



Missouri River Mainstem System Storage Zones and Allocations



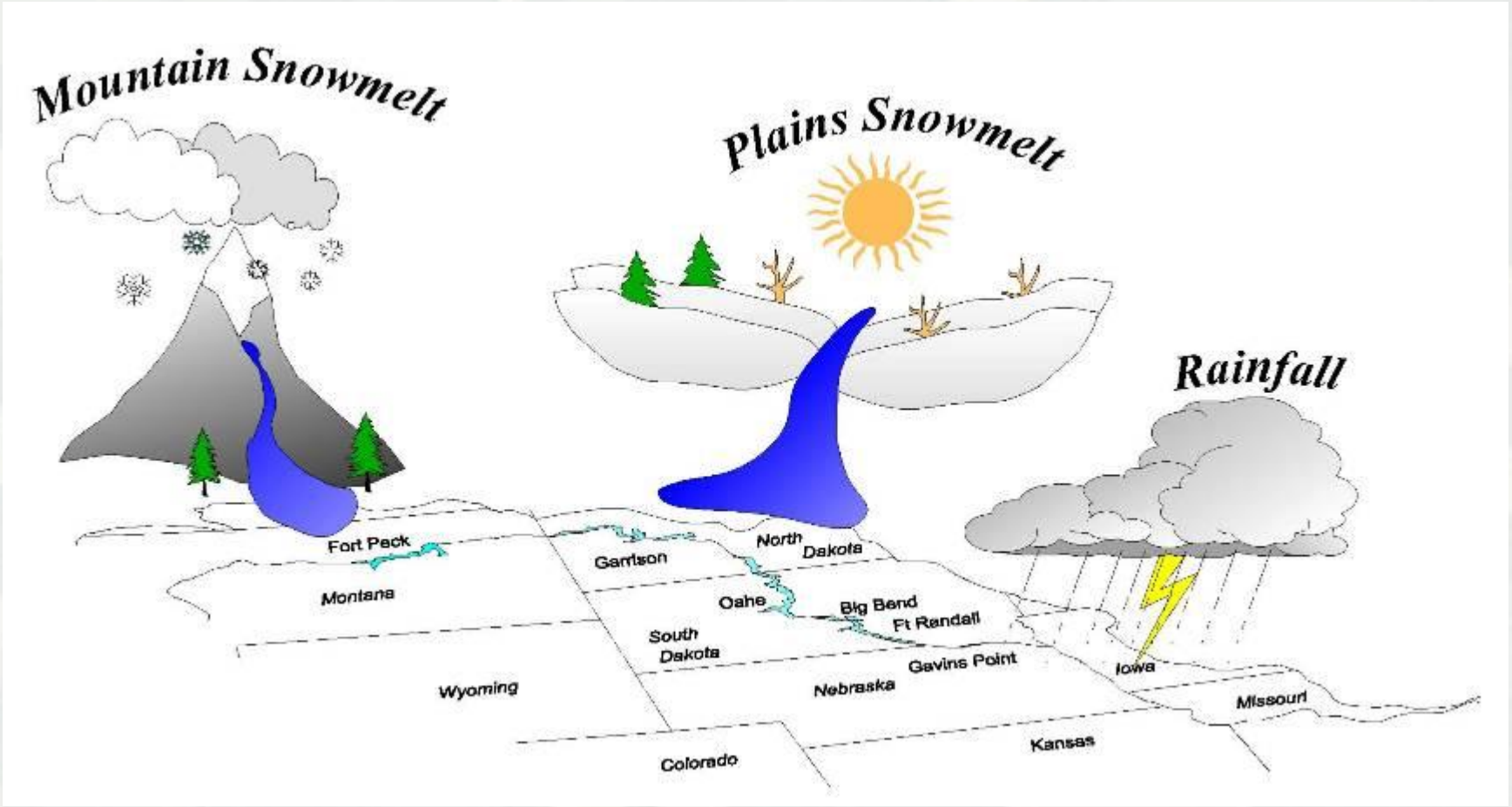
Flood Control Storage Capacity
Mainstem Reservoir System



The shapes are to scale and represent the relative size of the total flood control storage (annual + exclusive) at the six mainstem projects.

Project	Total Flood Control Storage (Ac-Ft)	% of Total Flood Storage
Fort Peck	**3,675,000**	**22.6**
Garrison	**5,711,000**	**35.1**
Oahe	**4,303,000**	**26.5**
Big Bend	**177,000**	**1.1**
Fort Randall	**2,294,000**	**14.1**
Gavins Point	**108,000**	**0.7**

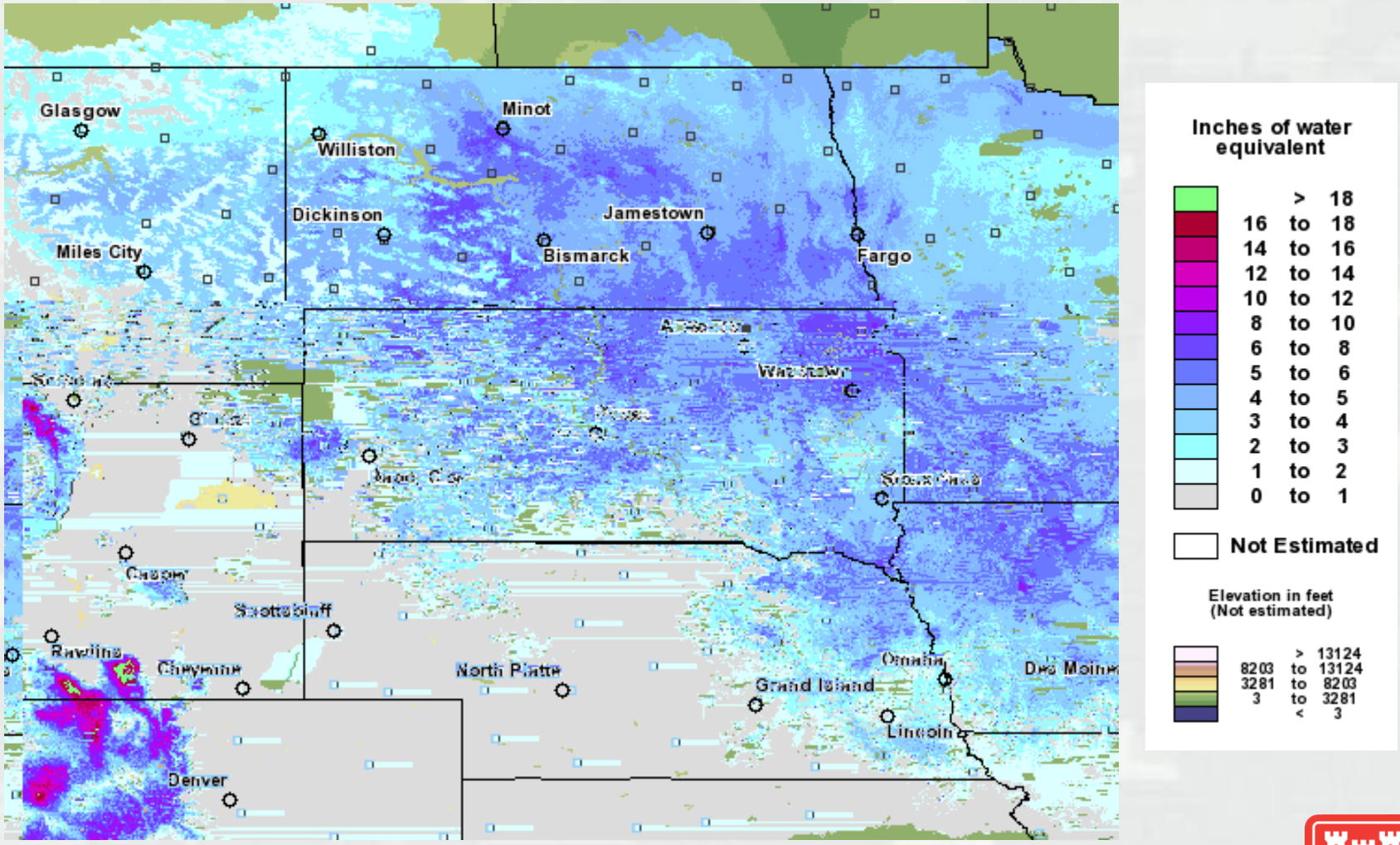
Types of Missouri River Basin Runoff



2010 Flood
Initial Conditions

- Full flood control capacity of the mainstem reservoir system was available at start of runoff season
  - Garrison and Oahe at base of Annual Flood Control
  - Additional storage available in Carryover Multiple Use at Fort Peck
  - Refill of Fort Randall limited due to plains snowpack
  - Gavins Point and Big Bend at desired operating levels

Plains Snowpack



20 February 2010

March 2010

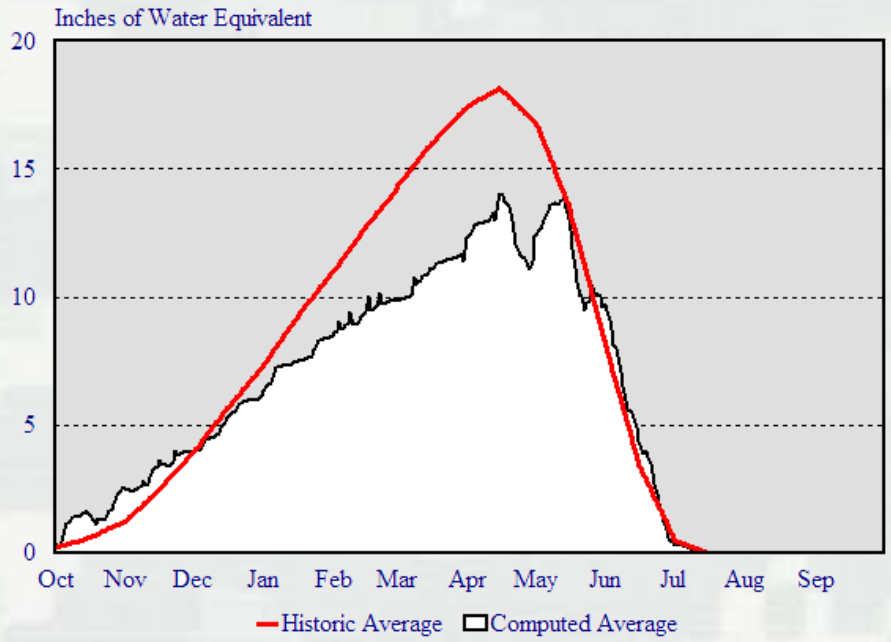
- March 1 to April 1 reservoir elevation changes
  - Fort Peck +1.8 feet to elevation 2224.2 feet
  - Garrison + 0.9 foot to elevation 1838.3 feet
  - Oahe + 5.9 feet to elevation 1613.9 feet
  - Fort Randall + 12.2 feet to elevation 1361.1 feet
- Mountain snowpack well below normal on April 5
  - Fort Peck 73 percent of normal
  - Garrison 74 percent of normal

April and May 2010

- Initial melt of mountain snowpack began in late April
- Cold temperatures and additional heavy snow occurred in May
  - Mountain snowpack accumulations at or above previous peaks by mid-May
  - Delayed melt accompanied by rain results in above normal runoff

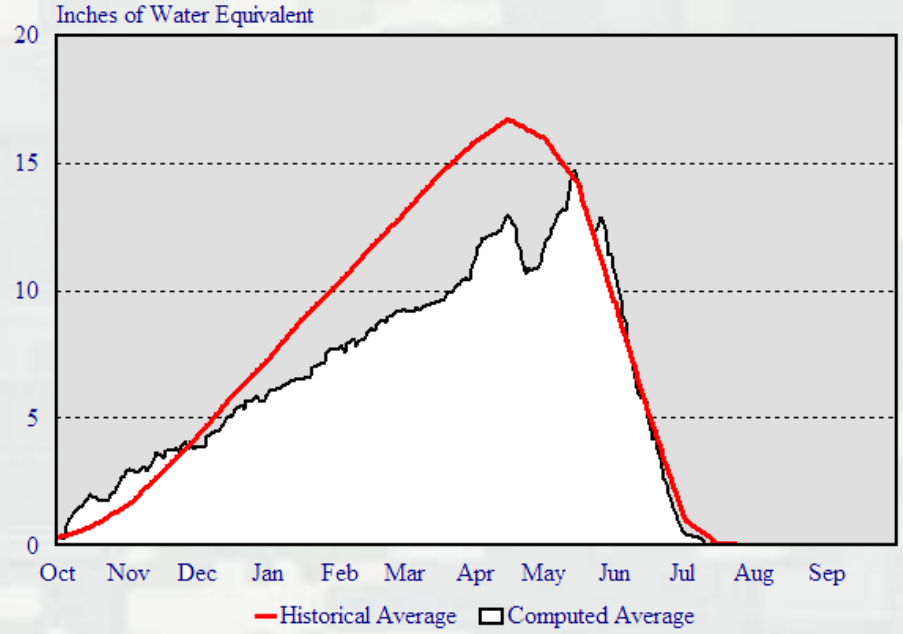
Mountain Snowpack Water Content 2009-2010

Total Above Fort Peck



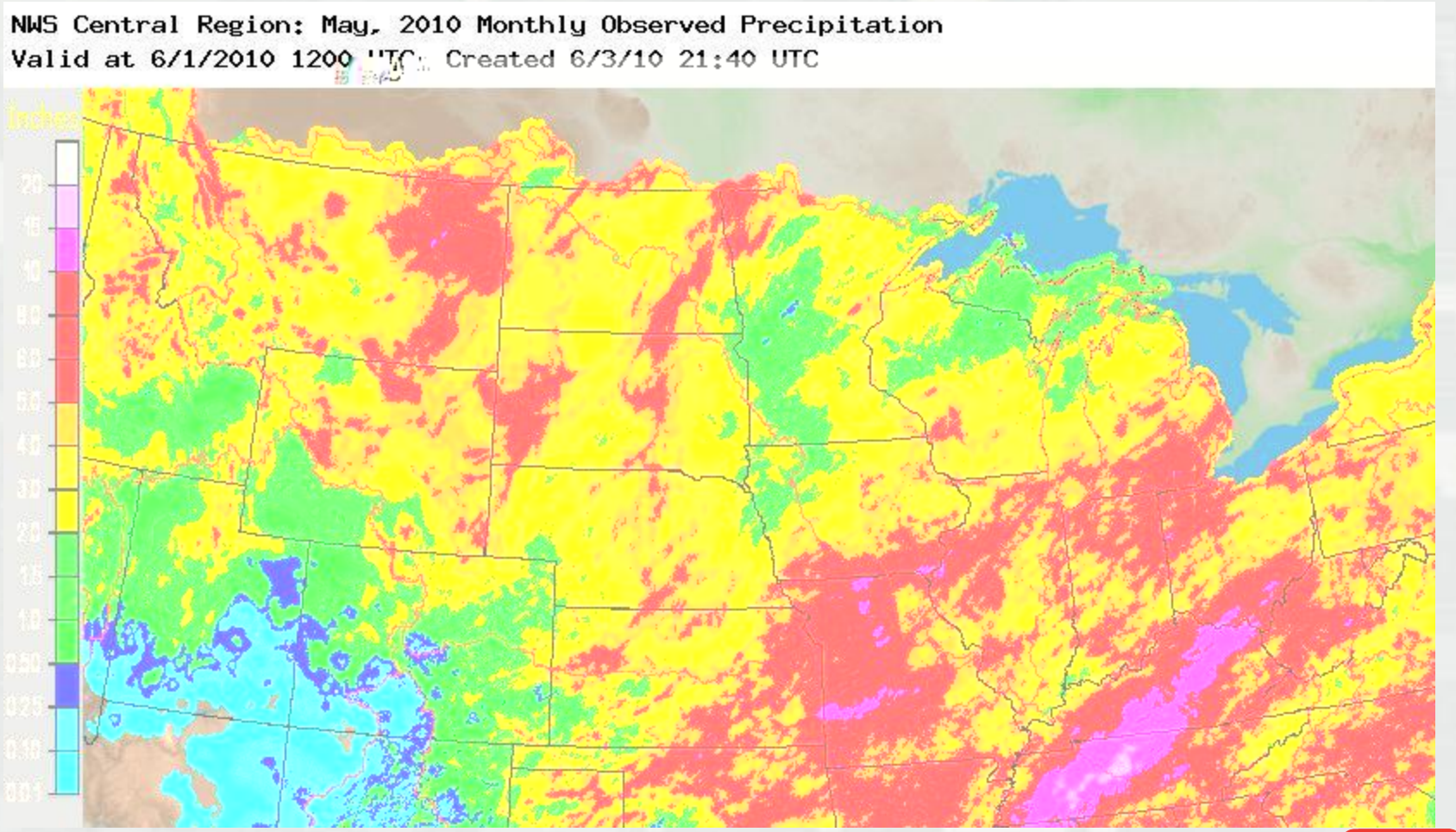
The Mountain Snowpack in the reach above Fort Peck peaked at 77% of the normal peak accumulation on April 15.

Total Fort Peck to Garrison



The Mountain Snowpack in the reach between Fort Peck and Garrison peaked at 88% of the normal peak accumulation on May 13.

Observed Precipitation – May 2010

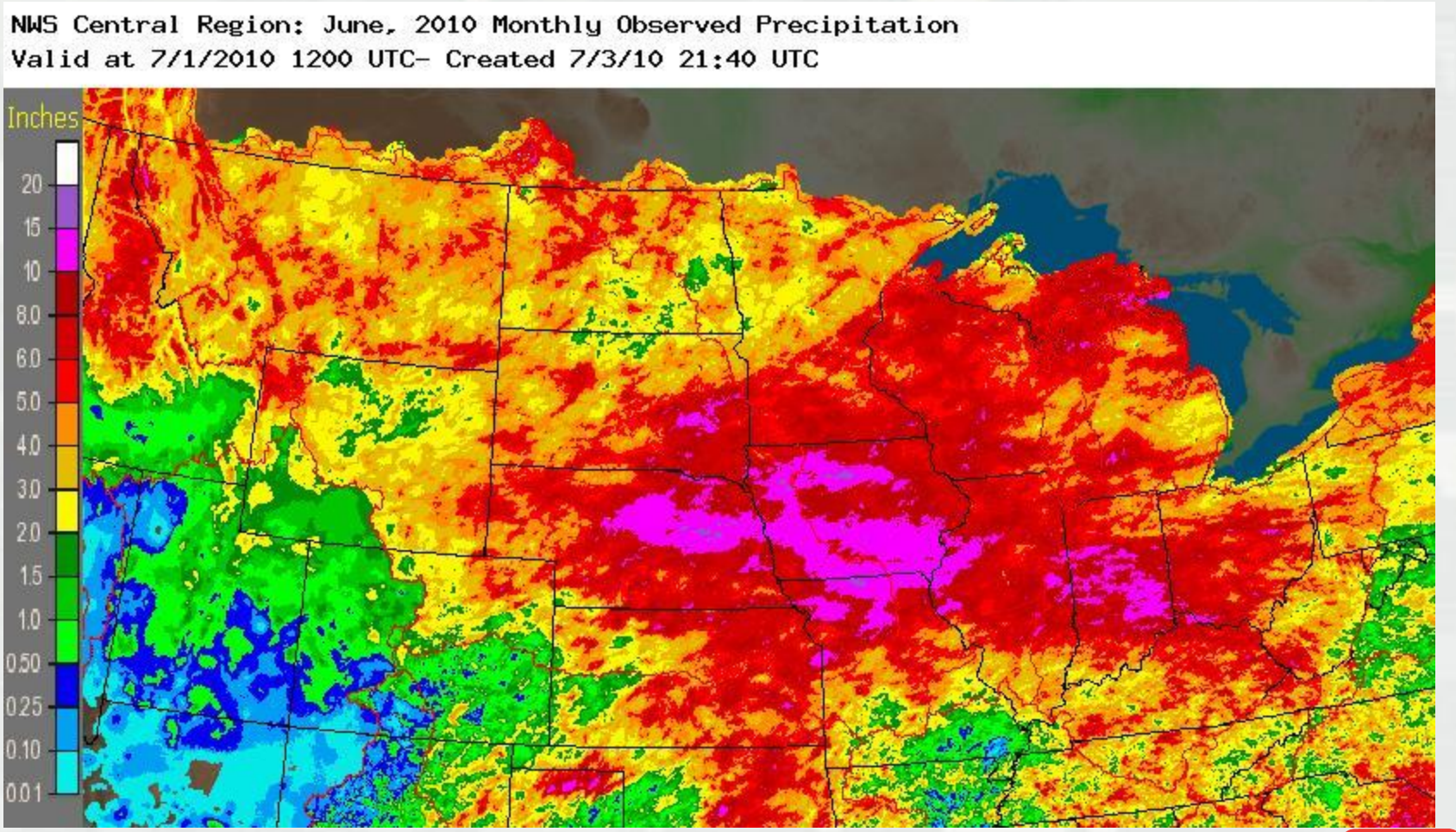


April and May 2010

- Heavy rain causes flooding across lower basin
- April 1 to June 1 reservoir elevation changes
  - Fort Peck +2.2 feet to elevation 2227.4 feet
  - Garrison + 2.7 feet to elevation 1841.0 feet
  - Oahe + 3.3 feet to elevation 1617.2 feet*
  - Fort Randall – 0.3 feet to elevation 1360.8 feet

* Oahe exclusive zone extends from 1617.0 to 1620.0

Observed Precipitation – June 2010



June 2010

- Extensive flooding below reservoir system due to heavy rain over uncontrolled drainage areas
  - Lower 600 miles of Missouri River above flood stage in June & July
  - Several communities and thousands of acres of cropland inundated
- Numerous levee systems threatened
  - Five non-federal levees failed; many sustained damage
  - Federal levees held, but several sustained damage

2010 Flood Control Operations
Fort Peck

- Releases have been maintained at minimum level to meet downstream requirements since the fall of 2008
- Peak inflows = 36,000 cfs
- Releases during flood event = 5,000 to 6,500 cfs
  - ► Coordinated release reduction with irrigators during periods of rain and high flows on the Milk River
- Reservoir captured over 2.7 million acre-feet of runoff since March 1
- Currently peaking 1.8 feet into annual flood control zone and steady
  - ► July 5 marked the official end of drought impacts

2010 Flood Control Operations
Garrison

- Peak inflows = 85,000 cfs
- Releases during flood event = 14,500 to 16,500 cfs
  - Releases scheduled to meet municipal and industrial water supply needs below the dam
- Reservoir captured over 4.5 million acre-feet of runoff since March 1
- Reservoir peaked at elevation 1851.4 feet on July 30, 1.4 feet into 4-foot exclusive flood control zone
- Currently 0.8 foot below exclusive zone and declining slowly

2010 Flood Control Operations
Oahe

- Peak inflows = 65,000 cfs
- Releases scheduled based on downstream conditions
- Reservoir captured over 3.2 million acre-feet of runoff since March 1
- Reservoir peaked at elevation 1617.9 feet on June 26, 0.9 foot into 3-foot exclusive flood control zone;
- Currently 4.6 feet into annual flood control pool and declining slowly

2010 Flood Control Operations
Big Bend

- Reservoir maintained in a narrow 1-foot operating band
- Very little flood control storage; primarily a hydropower dam

2010 Flood Control Operations
Fort Randall

- Winter refill limited due to heavy plains snowpack
- Peak inflows = 64,000 cfs
- Releases scheduled based on downstream conditions
  - ► Reduced to near zero when Gavins Point was very high
- Reservoir captured over 1.6 million acre-feet of runoff since March 1
- Reservoir peaked at elevation 1368.1 feet on June 22, 3.1 feet into 10-foot exclusive flood control zone
- Annual fall drawdown below base of annual flood control zone currently ongoing

2010 Flood Control Operations
Gavins Point

- Peak inflows = 44,000 cfs
- Releases scheduled based on upstream and downstream conditions
- Very little flood control storage
- Reservoir peaked at elevation 1209.7 feet on June 14, 1.7 feet into 2-foot exclusive flood control zone, just 0.3 feet from top of gates
- Release reductions made on two occasions
  - ► June 12-14
  - ► June 21-26

2010 Flood Control Operations
June12-14, 2010

- Gavins Point releases reduced 26,500 cfs to 22,000 cfs in response to downstream flooding
  - Heavy rain in Fort Randall to Gavins Point drainage area followed
  - Releases increased to 33,000 cfs on June 14 to prevent flow over top of spillway gates

Gavins Point Spillway

June 15, 2010

2010 Flood Control Operations
June 21-26, 2010

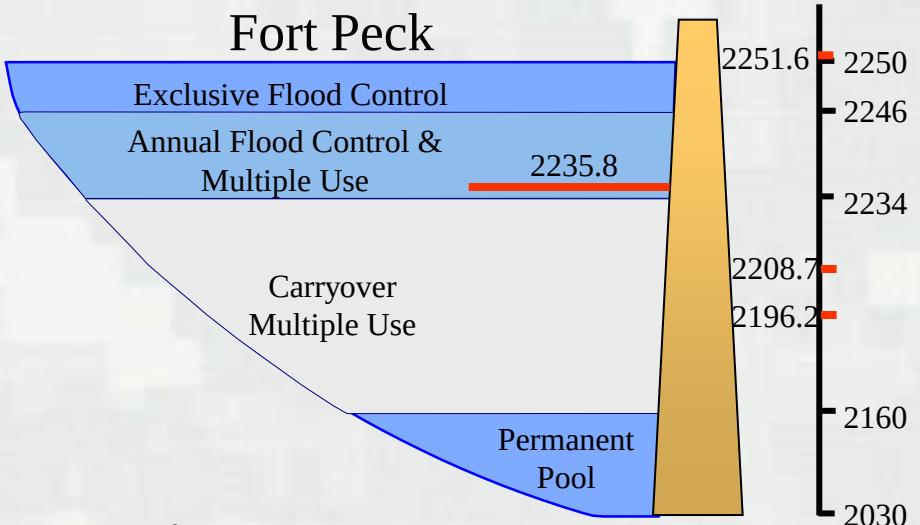
- Gavins Point releases reduced from 33,000 cfs to 15,000 cfs
  - Largest 1-day reduction in system releases
  - 15,000 cfs held for 2.5 days
  - Significant rises in Gavins Point and Fort Randall
  - Releases stepped up to full powerplant capacity 34,000 cfs over 4 days

2010 Flood Control Operations Summary

- Full flood control capacity of the mainstem reservoir system was available at start of runoff season
- Four of the six reservoirs have utilized the exclusive flood control zones this year
- Mainstem and tributary reservoirs reduced flows as much as 80,000 to 100,000 cfs during flood event
- Forecast annual runoff above reservoir system is 37.3 million acre-feet, 150 percent of normal, and the 3rd wettest year since 1898

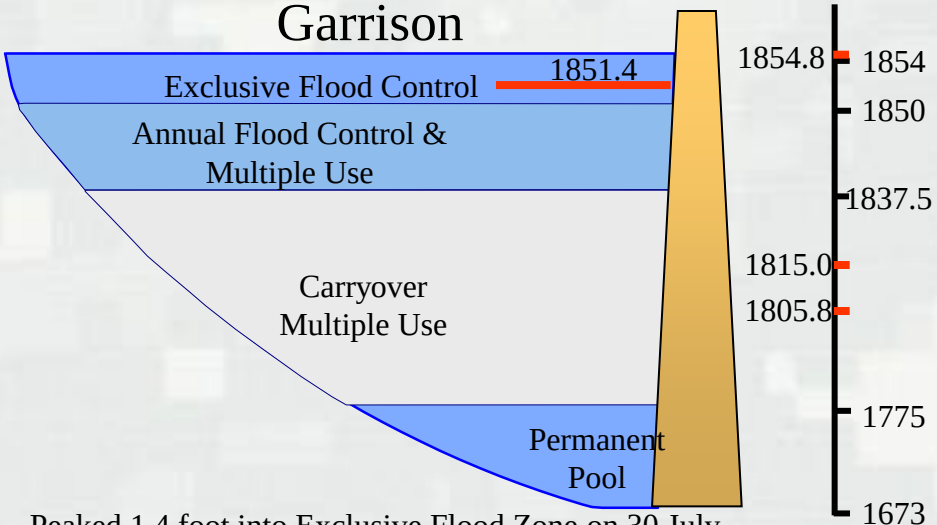
Peak Reservoir Levels – Summer 2010

Fort Peck



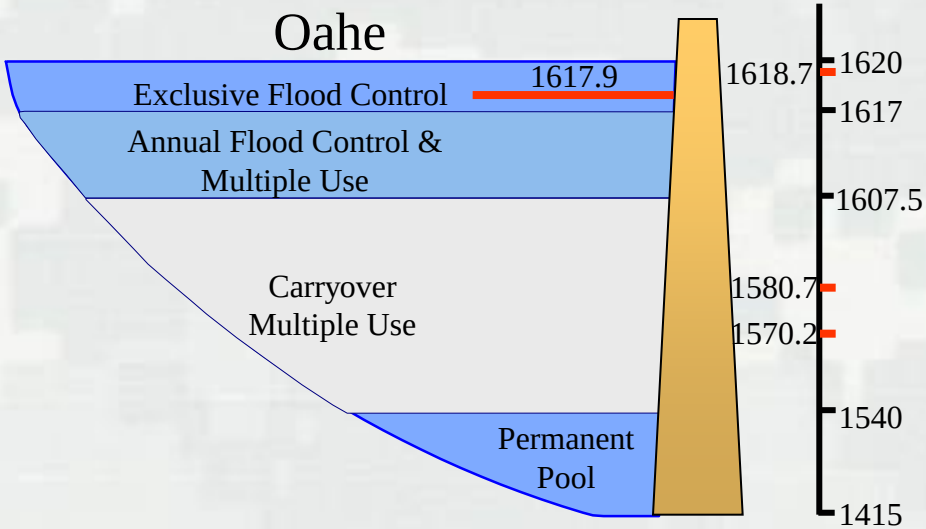
Peaked 1.8 feet into Annual Flood Zone on 10 August
Current Elevation = 2235.8 ft

Garrison



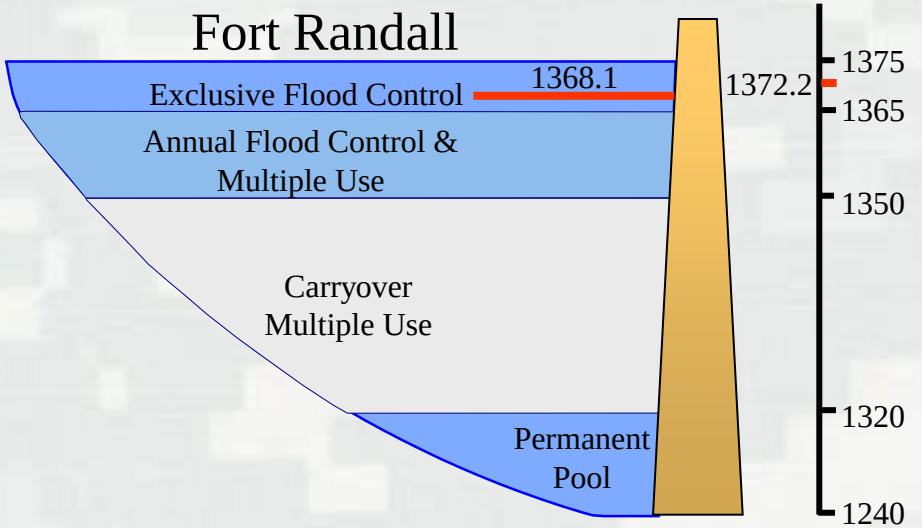
Peaked 1.4 foot into Exclusive Flood Zone on 30 July
Current Elevation = 1849.2 ft

Oahe



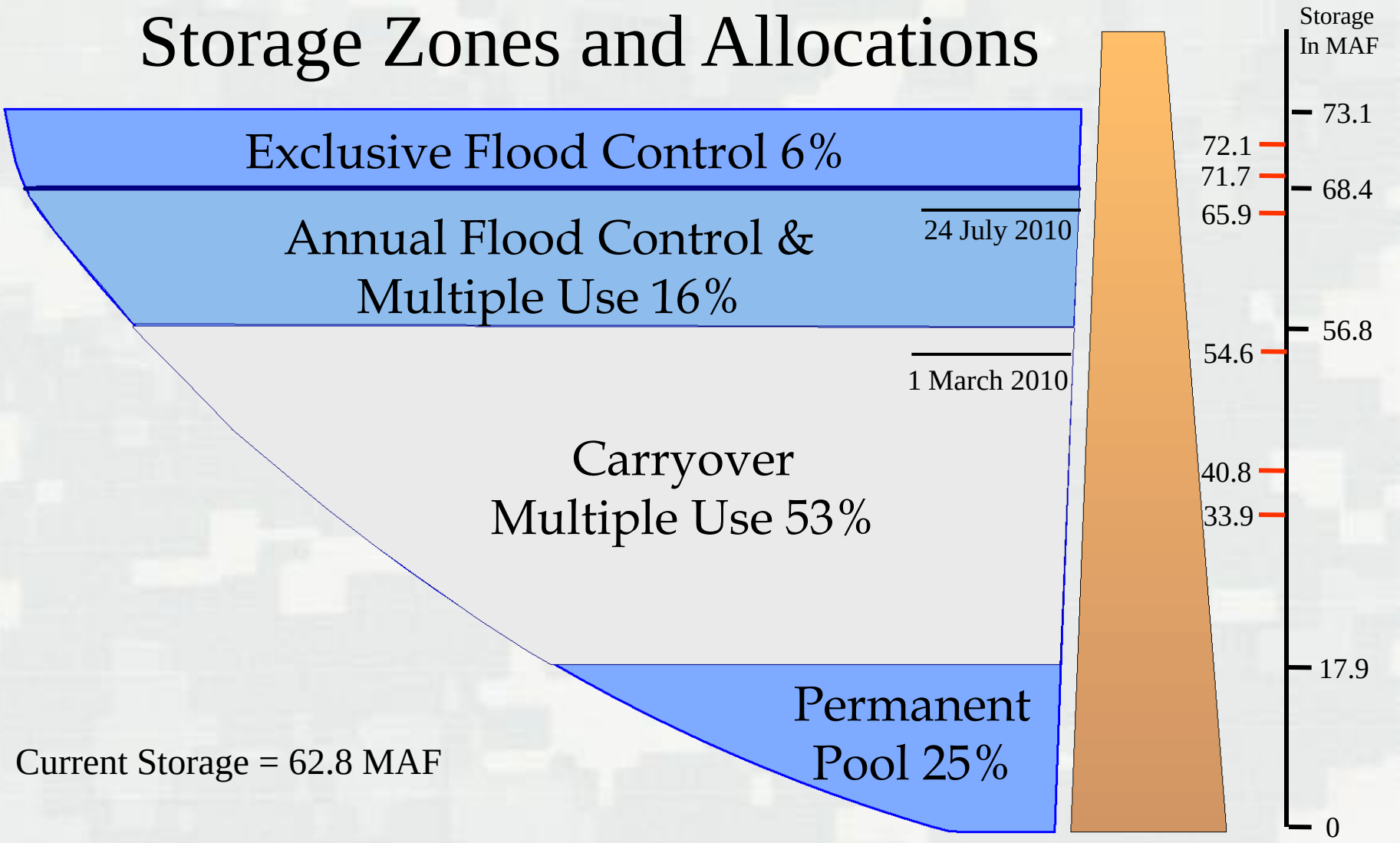
Peaked 0.9 feet into Exclusive Flood Zone on 27 June
Current Elevation = 1612.1 ft

Fort Randall



Peaked 3.1 feet into Exclusive Flood Zone on 23 June
Current Elevation = 1352.8 ft

Missouri River Mainstem System Storage Zones and Allocations



2010 Flood Control
The Way Ahead: Flood Evacuation

- In process of evacuating over 9 MAF of stored flood waters by start of next year's runoff season on 1 March
- Evacuation releases maintained through early December
  - ► 10-day extension to navigation season
- Higher than normal winter releases planned
  - ► Good for winter energy production
  - ► Reduces intake concerns during periods ice formation

Questions and Discussion?